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BULLETIN

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# Phytogeographical notes on the Rocky Mountain region X. Grasslands and other open formations of the Montane Zone of the Southern Rockies

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In a previous article* I have discussed the wooded formations of the Montane Zone. In this article the remaining formations are taken up. In these, the plants of the plains and foothills make up a larger proportion of the vegetation than in the wooded formations. The river valleys, meadows, and hog backs have a flora much more like that of similar habitats in the foothill region and even on the plains. The transcontinental elements and those from the prairie region are much more numerous.

The formations have been arranged so that the hydrophytic are first taken up and then the mesophytic, the most xerophytic being left until the last. The species followed by a dagger, "†", are confined to the Southern Rockies.

## A. AQUATIC FORMATIONS

Lakes are not very common in the Montane Zone of the Southern Rockies. In the higher parts they are mostly glacial, fed by the snow fields, and contain little vegetation. The brooks are swift and rarely form lakes or ponds in the higher regions. Most of the lakes are found in the lower river valleys and "Parks"

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* Bull. Torrey Club 47: 441–454. 1920.

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of Colorado, and here we find most of the aquatic vegetation. The majority of the phaneorgamic plants are found also in the plains and prairie regions. To these belong a score of species of *Potamogeton* which here are omitted. Besides these the following species are found:

### 1. TRANSCONTINENTAL AND EASTERN

*Sparganium angustifolium*
*Sparganium minimum*
*Triglochin palustris*
*Triglochin maritima*
*Alisma brevipes*
*Sagittaria latifolia*
*Phragmites Phragmites*
*Catabrosa aquatica*
*Panicularia grandis*
*Panicularia borealis*
*Panicularia septentrionalis*
*Eleocharis palustris*
*Scirpus validus*
*Lemna trisulca*
*Lemna gibba*
*Lemna minor*
*Persicaria coccinea*
*Batrachium trichophyllum*
*Batrachium flaccidum*
*Batrachium Drouetii*
*Ranunculus Purshii*
*Sisymbrium Nasturtium-aquaticum*
*Callitriche palustris*
*Callitriche autumnalis*
*Hippuris vulgaris*
*Sium cicutifolium*
*Menyanthes trifoliata*
*Veronica americana*
*Utricularia vulgaris*
*Utricularia minor*

### 2. WESTERN

*Crunocallis Chamissonis*
*Nymphaea polysepala*

### 3. ENDEMIC

*Panicularia pauciflora*
*Agrostis depressa*†
*Cardamine cordifolia*†
*Cardamine infausta*†
*Ranunculus intertextus*†

## B. SEDGE BOGS

The sedge bogs are found where the drainage is poor or in low places around lakes, ponds, and streams. In most cases the most numerous plants are species of *Carex*, but many grasses also are intermixed, and in some places they are predominant. Of these *Alopecurus aristulatus* and *Agrostis alba* are the most frequent and, in the lower part of the zone, species of *Calamagrostis*. The composition of the bog vegetation consists of the following plants:—

### 1. Continental and eastern

*Deschampsia coespitosa*
*Phalaris arundinacea*
*Calamagrostis elongata*
*Calamagrostis canadensis*
*Calamagrostis hyperborea*
*Beckmannia erucaeformis*
*Panicularia nervata*
*Alopecurus aristulatus*
*Eriophorum angustifolium*
*Eriophorum gracile*
*Carex gynocrates*
*Carex diandra*
*Carex disperma*
*Carex canescens*
*Carex brunnescens*
*Carex leptalea*
*Carex aurea*
*Carex paupercula*
*Carex Buxbaumii*
*Carex aquatilis*
*Carex lanuginosa*
*Carex viridula*
*Carex rostrata*
*Carex retrorsa*
*Rumex occidentalis*
*Rumex mexicanus*
*Ranunculus sceleratus*
*Cardamine pennsylvanica*
*Parnassia parviflora*
*Argentina Anserina*
*Geum rivale*
*Viola palustris*
*Veronica Wormskjoldii*
*Elephantella groenlandica*
*Gnaphalium uliginosum*
*Senecio pauciflorus*
*Lycopodium annotinum*
*Equisetum arvense*
*Equisetum pratense*
*Equisetum variegatum*

### 2. Western

*Poa interior*
*Agrostis humilis*
*Agrostis grandis*
*Agrostis asperifolia*
*Agrostis idahoensis*
*Muhlenbergia comata*
*Carex simulata*
*Carex athrostachya*
*Carex tenuirostris*
*Carex Raynoldsii*
*Carex Kelloggii*
*Juncus Mertensianus*
*Iris missouriensis*
*Limnorchis viridiflora*
*Limnorchis borealis*
*Rumex hymenosepalus*
*Alsine strictiflora*
*Alsine obtusa*
*Alsine calycantha*
*Ranunculus alismaefolius*
*Ranunculus Eschscholtzii*
*Argentina argentea*
*Vicia oregana*
*Vicia sparsiflora*
*Epilobium brevistylum*
*Epilobium occidentale*
*Dodecatheon pauciflorum*
*Castilleja exilis*
*Mimulus Lewisii*
*Galium subtriflorum*
*Aster occidentalis*
*Aster Burkei*
*Erigeron salsuginosus*
*Gnaphalium sulphurescens*
*Arnica longifolia*

### 3. Endemic

*Alopecurus occidentalis*
*Graphephorum Shearii*†
*Panicularia pauciflora*
*Agrostis Rossae*
*Agrostis melaleuca*
*Agrostis Bakeri*†
*Carex pseudoscirpoidea*
*Carex ebenea*†
*Juncus truncatus*
*Juncus Hallii*
*Sisyrinchium alpestre*†
*Rumex praecox*†
*Rumex subalpinus*†
*Rumex densiflorus*†
*Ranunculus inamoenus*
*Ranunculus acriforme*
*Ranunculus micropetalus*†
*Caltha rotundifolia*†
*Aconitum porrectum*†
*Aconitum columbianum*
*Clementsia rhodantha*
*Vicia dissitifolia*†
*Epilobium ovatifolium*†
*Epilobium americanum*
*Epilobium stramineum*
*Epilobium Drummondii*
*Epilobium wyomingense*
*Angelica pinnata*
*Primula incana*
*Dodecatheon philoscia*†
*Dodecatheon radicatum*†
*Anthopogon thermalis*
*Swertia scopulina*
*Myosotis alpestris*
*Castilleja sulphurea*
*Castilleja wyomingensis*
*Orthocarpus purpureo-albus*
*Erigeron minor*
*Erigeron lonchophyllus*
*Arnica rhizomata*
*Arnica foliosa*
*Senecio cymbalarioides*
*Senecio nephrophyllus*
*Senecio crassulus*
*Senecio semiamplexicaulis*
*Senecio rapifolius*
*Senecio dispar*
*Senecio perplexans*

## C. SPRINGY PLACES

The springs and the wet places in their vicinity usually have a flora of their own. This consists of hydrophytes, growing either in the water itself or on the muddy shores. As a rule the plants are small in size.

### 1. Eastern and transcontinental

*Eleocharis acicularis*
*Lemna trisulca*
*Lemna minor*
*Lemna gibba*
*Sisymbrium Nasturtium-aquaticum*
*Parnassia parviflora*
*Tillaeastrum aquaticum*
*Callitriche palustris*
*Callitriche autumnalis*
*Epilobium adenocaulon*
*Myosotis alpestris*

### 2. Western

*Muhlenbergia filiformis*
*Juncus Mertensianus*
*Crunocallis Chamissonis*
*Parnassia fimbriata*
*Micranthes arguta*
*Androsace filiformis*
*Mimulus Langsdorfii*

### 3. Endemic

*Agrostis depressa*†
*Cardamine cordifolia*
*Cardamine infausta*†
*Radicula alpina*
*Micranthes rhomboidea*
*Micranthes arnoglossa*
*Oxypolis Fendleri*†
*Primula incana*
*Pleurogyne fontana*
*Mimulus puberulus*

## D. SANDY RIVER BANKS

The flora of the sandy river banks and sand-flats along the water courses is very meager. Besides some of the species which are enumerated below, under the heading "Sand-draws," there are found the following which require more moisture:—

*Eleocharis acicularis*
*Scirpus pauciflorus*
*Muhlenbergia Wolfii*†
*Sagina saginoides*
*Alsinopsis macrantha*†
*Myosurus aristulatus*
*Ranunculus reptans*
*Halerpestes Cymbalaria*
*Radicula alpina*
*Subularia aquatica**
*Tillaeastrum aquaticum**
*Gilia calcarea*†
*Androsace filiformis*
*Androsace diffusa*†
*Androsace subulifera*†
*Mimulus moschatus*
*Mimulus puberulus*
*Limosella aquatica**
*Erigeron minor*

## E. ALLUVIAL RIVER BANKS

The formations on the alluvial river banks and river flats are of three kinds. Along the smaller brooks, especially in the upper portion of the zone, they resemble much those of the Subalpine Zone, the most important plants being species of *Mertensia*, *Epilobium* and *Juncoides*. In the lower part of the zone *Urtica gracilis* and various composites constitute the greater part of the vegetation. At middle altitudes species of *Delphinium* and *Aconitum* often take their places. Very few of the plants are transcontinental or eastern.

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* Growing mostly in shallow water with sandy bottom.

### 1. TRANSCONTINENTAL

*Juncoides parviflorum*
*Juncoides intermedium*
*Juncoides spicatum*
*Urtica gracilis*
*Epilobium adenocaulon*
*Veronica Wormskjoldii*
*Artemisia biennis*

### 2. WESTERN

*Amaranthus Powellii*
*Delphinium multiflorum*
*Epilobium occidentale*
*Rudbeckia occidentalis*
*Senecio triangularis*

### 3. ENDEMIC

*Delphinium occidentale*
*Delphinium reticulatum*
*Delphinium robustum*†
*Delphinium elongatum*†
*Delphinium ramosum*†
*Delphinium cucullatum*†
*Aconitum insigne*
*Aconitum lutescens*
*Aconitum Bakeri*†
*Epilobium Palmeri*†
*Epilobium rubescens*†
*Epilobium stramineum*†
*Mertensia ciliata*
*Mertensia Leonardi*†
*Mertensia brevistyla*†
*Scrophularia occidentalis*
*Rudbeckia ampla*
*Rudbeckia montana*†
*Helianthella quinquenervis*
*Cirsium Parryi*†
*Cirsium scopulorum*†
*Cirsium Centaureae*†
*Cirsium Eatonii*
*Cirsium coloradense*†
*Cirsium oreophilum*†
*Cirsium foliosum*
*Cirsium griseum*†

## F. MEADOWS

By meadows I mean here the more moist meadows of the richer bottom lands. There are also grasslands which bear hay-making grasses in the dryer portions of the valleys, which I have included in the Dry Valley Formation. The grasses of the wet meadows consist mostly of species of the tribes Agrostideae and Festuceae. Those of the latter are mostly of the tribe Hordeae and are found on the plains also. The list of grasses is given in an earlier article* and is here omitted.

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* Bull. Torrey Club **43**: 635–636. 1915.

### 1. Eastern and transcontinental

*Carex stenophylla*
*Carex lanuginosa*
*Carex interior*
*Juncus Vaseyi*
*Juncus bufonius*
*Polygonum ramosissimum*
*Capnodes aureum*
*Arabis ovata*
*Draba nemorosa*
*Vicia trifida*
*Viola nephrophylla*
*Viola septentrionalis*
*Viola pedatifida*
*Artemisia biennis*

### 2. Western

*Juncus longistylis*
*Juncus confusus*
*Juncodes comosum*
*Anticlea elegans*
*Polygonum sawatchense*
*Polygonum Watsonii*
*Potentilla Bakeri*
*Potentilla Nuttallii*
*Potentilla diversifolia*
*Drymocallis glandulosa*
*Lupinus argenteus*
*Astragalus striatus*
*Astragalus goniatus*
*Viola venosa*
*Viola vallicola*
*Oenothera Hookeri*
*Lavauxia flava*
*Collomia linearis*
*Orthocarpus luteus*
*Antennaria corymbosa*
*Arnica Rydbergii*
*Arnica fulgens*
*Agoseris laciniata*

### 3. Endemic

*Juncus Jonesii*
*Carex pseudoscirpoidea*
*Veratrum tenuipetalum*†
*Calochortus Gunnisoni*
*Calochortus Nuttallii*
*Calochortus acuminatus*
*Polygonum Engelmannii*
*Claytonia rosea*
*Thalictrum venulosum*
*Thalictrum megacarpum*
*Arabis rhodantha*
*Potentilla filipes*
*Potentilla juncunda*
*Potentilla pulcherrima*
*Potentilla plattensis*
*Potentilla propinqua*
*Potentilla Nelsoniana*
*Fragaria pauciflora*
*Drymocallis convallaria*
*Trifolium Rydbergii*
*Trifolium Kingii*†
*Astragalus sulphurescens*
*Aragallus albiflorus*
*Lathyrus brachycalyx*†
*Viola bellidifolia*
*Primula incana*
*Anthopogon thermalis*
*Castilleja brunnescens*†
*Plantago Tweedyi*
*Campanula Parryi*
*Erigeron consobrinus*†
*Gnaphalium exilifolium*†

*Gnaphalium Grayi*†
*Senecio pudicus*†
*Senecio anacletus*†
*Senecio atratus*†
*Agoseris purpurea*†
*Agoseris arizonica*†
*Agoseris attenuata*†
*Agoseris arachnoidea*†
*Agoseris maculata*†
*Agoseris leptocarpa*†
*Ptilocalais tenuifolia*†
*Leontodon mexicanus*†

## G. SALT AND ALKALI MEADOWS

Where the soil contains salt or alkali, the meadow is more or less modified. While the salt and alkali meadows are very common in the Submontane Zone, in the Montane Zone they are uncommon, as the drainage as a rule is much better. In the South Park of Colorado, however, there are salt or alkali meadows of great extent. This may also be the case in the other two large parks. They are common in the St. Louis Valley, but this is mostly below the Montane Zone. The vegetation contains among others the following species:—

*Triglochin palustris*
*Triglochin maritima*
*Alisma brevipes*
*Puccinellia Nuttallii*
*Spartina gracilis*
*Distichlis stricta*
*Agropyron Smithii*
*Agropyron molle*
*Elymus simplex*
*Dondia erecta*
*Sarcobatus vermiculatus*
*Monolepis Nuttalliana*
*Ranunculus sceleratus*
*Halerpestes Cymbalaria*
*Plantago eriopoda*
*Arnica foliosa*
*Tetradymia inermis*

## H. DRY VALLEYS AND BENCHLANDS

The general description of this formation and a list of the grasses it contains are given in a previous paper.* The list of grasses will here be omitted. The other plants making up the flora are as follows:

### 1. Eastern or transcontinental

*Carex siccata*
*Polygonum buxiforme*
*Lepidium densiflorum*
*Anogra latifolia*
*Anogra coronopifolia*
*Plantago Purshii*
*Plantago eriopoda*
*Laciniaria punctata*
*Chrysopsis villosa*
*Rudbeckia hirta*
*Solidago glaberrima*

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* See Bull. Torrey Club **42**: 637–638. 1915.

### 2. Western

*Carex Douglasii*
*Carex Hoodii*
*Carex phaeocephala*
*Carex obtusata*
*Eriogonum stellatum*
*Eriogonum umbellatum*
*Arenaria congesta*
*Arenaria Burkei*
*Anemone globosa*
*Thlaspi Nuttallii*
*Arabis retrofracta*
*Peritoma serrulatum*
*Lupinus caespitosus*
*Lupinus argenteus*
*Gilia aggregata*
*Castilleja linearifolia*
*Aster campestris*
*Antennaria rosea*
*Antennaria flavescens*
*Antennaria concinna*
*Antennaria oblanceolata*
*Gymnolomia multiflora*
*Helianthus petiolaris*
*Madia glomerata*

### 3. Endemic

*Eriogonum* (8 species)†
*Polygonum Engelmannii*
*Wahlbergella Drummondii*
*Wahlbergella comosa*
*Arenaria* (3 species)†
*Lepidium* (3 species)†
*Physaria* (3 species)†
*Lesquerella montana*†
*Cheirinia Wheeleri*†
*Arabis* (5 species)†
*Arabis Drummondii*
*Arabis connexa*
*Potentilla effusa*
*Potentilla Hippiana*
*Chamaerhodos Nuttallii*
*Lupinus aduncus*
*Aragallus albiflorus*
*Geranium* (3 species)†
*Cynomarathrum Nuttallii*†
*Gilia scariosa*†
*Gilia candida*†
*Phacelia glandulosa*
*Oreocarya thyrsiflora*†
*Oreocarya virgata*†
*Lithospermum multiflorum*†
*Campanula Parryi*†
*Chrysopsis resinolens*
*Chrysopsis caudata*†
*Grindelia erecta*
*Pyrrocoma* (3 species)
*Solidago* (3 species)
*Townsendia grandiflora*
*Machaeranthera* (7 species)†
*Erigeron flagellaris*
*Antennaria* (5 species)
*Hymenoxis helenioides*†
*Senecio* (8 species)†
*Crepis* (4 species)

## I. GRASSY HILLSIDES

In richer soil the principal grass is *Festuca ingrata*, whose place is taken on the southern slopes of the Southern Rockies by *F. arizonica* and in less degree by *F. Thurberi*. The composition of the flora consists of the following species.

### 1. Eastern and transcontinental

*Calamagrostis purpurascens*
*Poa crocata*
*Festuca rubra*
*Carex concinna*
*Carex Halleri*
*Ibidium strictum*
*Draba nemorosa*

### 2. Western

*Carex Rossii*
*Ibidium porrifolium*
*Allium Geyeri*
*Eriogonum ovalifolium*
*Polygonum sawatchense*
*Eurotia lanata*
*Cerastium strictum*
*Draba nitida*
*Sieversia grisea*
*Sieversia ciliata*
*Collomia linearis*
*Phacelia sericea*
*Lappula floribunda*
*Campanula petiolata*
*Aster apricus*
*Macronema suffruticosum*
*Antennaria pulcherrima*
*Antennaria anaphaloides*
*Balsamorrhiza sagittata*
*Wyethia amplexicaulis*
*Arnica Parryi*
*Arnica mollis*

### 3. Endemic

*Muhlenbergia* (3 species)†
*Poa* (8 species)†
*Festuca ingrata*
*Festuca saximontana*
*Festuca* (3 other species)†
*Allium Brandegei*
*Allium recurvatum*
*Erythronium parviflorum*†
*Erythronium utahense*
*Cerastium* (4 species)
*Draba* (3 species)
*Lesquerella curvipes*†
*Lithophragma australis*†
*Potentilla* (5 species)
*Pachylophus macroglottis*
*Pachylophus hirsutus*
*Amarella scopulorum*
*Dasystephana affinis*
*Dasystephana Forwoodii*
*Tessaranthium* (5 species)†
*Phlox Kelseyi*
*Mertensia* (7 species)†
*Valeriana* (4 species)†
*Solidago* (3 species)
*Aster andinus*
*Erigeron viscidus*†
*Townsendia strigosa*†
*Helianthella uniflora*
*Tetraneuris leptoclada*
*Tetraneuris lanigera*
*Senecio Fendleri*

## K. HOG-BACKS AND DRY RIDGES

The flora of the hog backs in the Montane Zone, especially in its upper part, resembles that of the Subalpine Zone; in the lower regions there are many of the species of the dry plains added. Besides these there are a few restricted to the Montane Zone; nearly all of these are endemics. The flora consist of the following:

### 1. Eastern or transcontinental

*Juniperus sibirica*
*Carex praticola*
*Carex stenophylla*
*Calamagrostis purpurascens*
*Bouteloua gracilis*
*Koeleria gracilis*
*Poa crocata*

### 2. Western

*Lewisia rediviva*
*Oreobroma pygmaea*
*Oreobroma nevadensis*
*Draba lutea*
*Sedum stenosepalum*
*Petrophytum caespitosum*
*Leptodactylon purgens*

### 3. Endemic

*Lesquerella alpina*
*Eriogonum* (6 species)†
*Physaria vitulifera*
*Physaria acutifolia*
*Trifolium nanum*
*Trifolium dasyphyllum*†
*Kentrophyta aculeata*
*Kentrophyta Wolfii*†
*Aragallus minor*
*Phlox depressa*
*Phlox Kelseyi*
*Chrysopsis pumila*
*Townsendia strigosa*†
*Townsendia montana*†
*Erigeron ursinus*
*Antennaria rosulata*†
*Tetraneuris lanigera*†
*Tetraneuris brevifolia*
*Senecio Purshianus*
*Senecio Fendleri*†
*Senecio werneriaefolius*†

## SAND HILLS AND SAND-HILL DRAWS

While the best developed sand and sand-hill draws are found in the region of the Great Plains east of the Rockies, and in the desert plains of the Great Basin west of the same; they are found also in the Submontane and Montane Zones. In the latter the sand-draws are found mostly in the bottoms of the canyons and the sandhills in the so-called "Parks" of Colorado and in some of the broader river valleys. Most of the species characteristic of both are also found on the Great Plains and are such as have migrated along the rivers to higher altitudes. The following species are components of the flora. None of these are transcontinental or common to the Rockies and the Canadian Zone. A few are common to the Rocky Mountains and the Sierra Nevada Region, but most of them are endemics, either of the Great Plains or the Great Basin, or both.

*Eriocoma hymenoides*
*Muhlenbergia pungens*
*Stipa speciosa*
*Oryzopsis Webberi*
*Sitanion elymoides*
*Arenaria confusa*
*Arenaria polycaulos*
*Peritoma serrulatum*
*Epilobium paniculatum*
*Gayophytum intermedium*
*Gayophytum ramosissimum*
*Gayophytum racemosum*
*Nuttallia multiflora*
*Nuttallia densa*
*Nuttallia speciosa*
*Cryptantha Torreyana*
*Lithospermum multiflorum*
*Helianthus petiolaris*

## M. ROCK SLIDES

The rock slide flora of the upper Montane Zone resembles that of the Subalpine, which has already been described.* In lower altitudes the following species appear, all of which are endemic to the Southern Rockies except *Viola biflora*, which is found also in Europe.

*Elymus ambiguus*†
*Aquilegia saximonana*†
*Aragallus Hallii*†
*Limnobotrya montigena*†
*Viola biflora*†
*Pseudopteryxia anisata*†
*Pseudopteryxia aletifolia*†
*Polemonium confertum*†
*Polemonium mellitum*†
*Polemonium Brandegei*†
*Pentstemon stenosepalus*†
*Senecio Fendleri*†
*Senecio amplectens*†
*Senecio canovirens*†

NEW YORK BOTANICAL GARDEN.

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* Bull. Torrey Club 44: 453. 1917.